

CLAIMS

1. A laser marking device that irradiates a laser beam on a workpiece to transform a portion inside the workpiece at a focal point of the laser beam, thus putting a dot in each predetermined area, characterized by comprising:

acquiring means that acquires, as information on the dot, at least two-dimensional position information of an exposed section of the workpiece, and density information of the dot;

coordinate setting means that calculates, for each dot according to the density information, dot depth information showing the distance from the surface of the workpiece to the dot in the thickness direction of the workpiece, and sets three-dimensional coordinates for each dot based on a position specified by the dot depth information and the two-dimensional position information acquired by said acquiring means; and

laser marking means that performs marking with the three-dimensional coordinates as a laser beam focal point.

2. A laser marking device that irradiates a laser beam on a workpiece to transform a portion inside the workpiece at a focal point of the laser beam, thus putting a dot in each predetermined area, characterized by comprising:

acquiring means that acquires, as information on the dot, at least two-dimensional position information of an exposed section of the workpiece, and density information of the dot;

marking information setting means that calculates, for each dot according to the density information, dot depth information showing the distance from the surface of the workpiece to the dot in the thickness direction of the workpiece, and dot diameter information showing the

diameter of the dot, sets three-dimensional coordinates for each dot based on a position specified by the dot depth information and the two-dimensional position information acquired by said acquiring means, and sets the dot diameter information for each dot in the three-dimensional coordinates, thereby forming marking information for each dot; and

laser marking means that performs marking by controlling a marking condition according to the marking information set by said marking information setting means.

3. The laser marking device according to claim 1 or 2, characterized in that the laser marking is performed for at least one dot in the area.

4. The laser marking device according to claim 1 or 2, characterized in that the workpiece is made of a light transmitting resin material, and comprises a core material, which is a colored material having light reflectivity, on the rear surface of the workpiece.

5. The laser marking device according to claim 1 or 2, characterized in that the workpiece is made of a light transmitting resin material, and comprises a core material, which is a colored material having light reflectivity, on the rear surface of the workpiece, and another workpiece is in contact with a surface opposite to the contact surface between the core material and the workpiece.

6. The laser marking device according to claim 5, characterized in that the core material is configured by building up two types of resin materials.

7. An object to be marked comprising a workpiece formed by a light transmitting resin material, and a core material which is a colored material having light reflectivity, and is built up on a rear surface of said workpiece, characterized in that marking is carried out such that a plurality of dots

different in the distance from the surface of said workpiece in the thickness direction are formed in said workpiece, and the difference in the depth among the plurality of dots causes the dots appear different in the density.

8. An object to be marked comprising a workpiece formed by a light transmitting resin material, and a core material which is a colored material having light reflectivity, and is built up on a rear surface of said workpiece, characterized in that marking is carried out such that a plurality of dots different respectively in the distance from the surface of said workpiece in the thickness direction and the diameter are formed in said workpiece, and the differences in the depth and the diameter of each dot cause the each unit area in which the dots are formed appears different in the density.

9. A laser marking method that irradiates a laser beam on a workpiece to transform a portion inside the workpiece at a focal point of the laser beam, thus putting a dot in each predetermined area, characterized by comprising:

an information acquiring step of acquiring, as information on the dot, at least two-dimensional position information of an exposed section of the workpiece, and density information of the dot;

a dot information acquiring step of calculating and acquiring, for each dot, according to the density information acquired by said information acquiring step, dot depth information showing the distance from the surface of the workpiece to the dot in the thickness direction of the workpiece, and dot diameter information showing the diameter of the dot;

a three-dimensional coordinate setting step of setting three-dimensional coordinates for each dot based on a position specified by the two-dimensional position information acquired by said information acquiring step and the dot depth information acquired by said dot

information acquiring step;

a marking information setting step of setting the dot diameter information acquired by said dot information acquiring step for each dot in the three-dimensional coordinates set by said three-dimensional coordinate setting step, thereby forming marking information; and

a laser marking step of adjusting a laser beam irradiating condition based on the marking information formed by said marking information setting step and then irradiating the laser beam on the workpiece.